

Manufacturing Technology II

Machine Shop

GRADE 10

June 2014

I. COURSE DESCRIPTION

Manufacturing Technology II is a full year study designed as a course to continue preparing the student for entry level employment or further training in the Machining Industry. This second year course is a continuation of knowledge and skill obtained from identifying and, understanding various related equipment and by producing custom made entities. Students will continue to be exposed to a real-work setting, practical machining applications and the machine industry environment. Students will develop their existing Core Skill Set within a manufacturing environment. By studying all of the aspects of the shop, students will not only prepare themselves for industry exams and future training , but they will gain an overall competitive edge in the Machining industry.

Students in the course will reinforce their existing skills from Manufacturing Technology I. Students will develop the skill to identify part characteristics and to interpret these characteristics into a procedure to create the part and to follow through to the completed part. Specifically, the sequence of steps is developed. The process introduces the process of material selection and estimating cost. It introduces Saw, Cutoff Machines. It also introduces the topics of Metal Characteristics, Heat Treatment of Metals and Product Finishing. Basic controls and applications of Grinding and cutting are reinforced. Maintenance of related equipment and lubrication techniques are covered.

Students skills will be enhanced with the continued use of Lathes, Milling Machines and Drilling Machines. Shop safety issues are reinforced. Students will reinforce their skills in the using Mastercam for the design of various projects. The student will also reinforce their skill in speaking the correct vernacular, as well as how to perform in a professional machine shop setting.

II. COURSE OBJECTIVES/OUTLINE

GRADE 10

- I. Careers in Machining Technology
 - A. Job Categories
 - B. Job Preparation
 - C. Keeping Skills Current
 - D. Personal Skills
 - E. Technical Skills
 - F. Training Opportunities
- II. Safety
 - A. Shop
 - B. OSHA Guidelines
 - C. Personal Protective Equipment
 - D. Guards and Barriers
 - E. Handling and Lifting
 - F. Compressed Air
 - G. Lockout and Tagout
 - H. Hazardous Materials
 - I. Fire Safety
 - J. Handtool Safety
 - K. Saw Safety
 - L. Drill and Grinding Safety
 - M. Lathe and Milling Machine Safety
 - N. Band Machine Safety
- III. Drawings
 - A. Prints
 - B. Types of Drawings
 - C. Dimensioning
 - D. Orthographic Projection
 - E. Reading and Interpreting Prints
- IV. Entity Development
 - A. Entity Evaluation
 - B. Material Selection
 - C. Alternate Solutions
 - D. Equipment Selection
 - E. Operation Sequence
- IV. Hand Tools
 - A. Basic Operation and Use
 - B. Striking Tools
 - C. Chisels
 - D. Hacksaw
 - E. Files
 - F. Reamers
 - G. Hand Threading
 - H. Hand Polishing

- V. Jigs and Fixtures
 - A. Jigs and Fixtures
 - B. Jig and Fixture Construction
- VI. Cutting Fluids and Coolants
 - A. Types of Fluids
 - B. Application of Cutting Fluids
- VII. Sawing and Cutoff Machines
 - A. Basic Operation and Use
 - B. Metal Cutting Power Saws
 - C. Power Hacksaw
 - D. Power Hand Saw
 - E. Metal-Cutting Circular Saws
- VIII. Drills and Drilling Machines
 - A. Basic Operation and Use
 - B. Cutting Speed and Feeds
 - C. Cutting Fluids
 - D. Sharpening Drills
 - E. Drilling, Countersinking and Counterboring
 - F. Spotfacing, Tapping, Reaming and Microdrilling
- IX. Grinding
 - A. Wet-Type, Dry-Type Grinder and Hand Grider
 - B. Surface Grinder
 - C. Work-Holding Devices
 - D. Grinding Applications and Problems
 - E. Universal Tool and Cutter Grinder
 - F. Sharpening Cutters
 - G. Cylindrical Grinding
 - H. Internal Grinding
 - I. Centerless and Form Grinding
- X. Lathe
 - A. Basic Operation and Use
 - B. Facing and Turning Operations
 - C. Boring
 - D. Drilling
 - E. Reaming and Knurling
 - F. Filing and Polishing
 - G. Mandrels
 - H. Grinding and Milling on Lathe
- XI. Tapers, Screw Threads and Broaching
 - A. Taper Turning
 - B. Measuring Tapers
 - C. Cutting Screw Threads
 - D. Broaches and Broaching Machines
 - E. Advantages of Broaching

- XII. Milling Machine
 - A. Basic Operation and Use
 - B. Work-Holding
 - C. Vertical Milling Machine
 - D. Machine Care
 - E. Horizontal Milling Machine
 - F. Cutting a Spur Gear
 - G. Cutting a Bevel Gear
 - H. Thread Milling
 - I. High-Velocity Machining
- XIII. Band Machine
 - A. Basic Operation and Use
 - B. Basics and Blade Selection
 - C. Welding Blades
 - D. Machine Preparation and Operations
 - E. Power Feed
- XIV. Metal Characteristics
 - A. Classifying Metals
 - B. Ferrous Metals
 - C. Nonferrous Metals
 - D. High-Temperature Metals
 - E. Rare Metals
- XV. Heat Treatment of Metal
 - A. Heat-Treatable Metals
 - B. Types of Heat Treatment
 - C. Heat-Treatment Equipment
 - D. Hardening and Tempering of Carbon Steel
 - E. Case Hardening Low-Carbon Steel
 - F. Hardness Testing
- XVI. Finishing
 - A. Quality of Machined Surfaces
 - B. Finishing Techniques
- XV. Metrology
 - A. Basic Understanding
 - B. Orthographic Projection
 - C. Thread and Thread Symbols and Notation
 - D. Drawing Standards
 - E. Welding Symbols
 - F. Dimensioning and Tolerancing
 - G. Dimensioning and Tolerancing Symbols
 - H. Applications and Calculation Methods

XVI. Mastercam

- A. Basic Understanding
- B. Tool path Chaining - How to select geometry
- C. Creating Tools – Tool Library's
- D. Post Processors – Creating G-Code
- E. Create Part Model and Program for Manufacture
- F. Create Tool sheet
- G. Machine the part complete to validate programming
- H. Edit Mastercam File to match finished part
- I. Mill – 3Axis
- J. Importing – Files, Models, Layers
- K. Set-up and Prove-out Program

A. THE PATH OF THE MANUFACTURING EQUIPMENT OPERATOR

The student will be able to:

1. Continue development in becoming a machine professional.
2. Recognize the importance of safety throughout the shop environment.
3. Understand the Quality Assurance process.
4. Understand metal composition and classification.
5. Demonstrate the heat treatment of metals.
6. Demonstrate maintenance and lubrication.
7. Understand drawings and measurement systems
8. Understand layouts.
9. Demonstrate the use of Saws and Cutoff Machines
10. Demonstrate the use of Drilling Machines
10. Understand the aspects of Grinding
10. Demonstrate the use of a Lathe
10. Demonstrate the use of a Band Machine
10. Demonstrate the use of Milling Machine
10. Understand various Metal Characteristics
11. Demonstrate the use of Mastercam.

New Jersey Core Curriculum Content Standards

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| 9.1.4.A.2 | Evaluate available resources that can assist in solving problems. |
| 9.1.8.A.4 | Design and implement a project management plan using one or more problem-solving strategies. |
| 9.1.4.D.3 | Demonstrate an awareness of one's own culture and other cultures during interactions within and outside of the classroom. |
| 9.1.4.F.3 | Explain the importance of understanding and following rules in family, classroom, and community settings. |
| 9.2.4.A.1 | Explain the difference between a career and a job, and identify various jobs in the community and the related earnings. |
| 9.3.4.A.4 | Identify qualifications needed to pursue traditional and nontraditional careers and occupations. |
| 9.3.4.A.5 | Locate career information using a variety of resources. |
| 9.4.12.B.(1).1 | Demonstrate communication skills and strategies that are used to work effectively with potential clients and others |
| 9.4.12.A.(3).1 | Recognize and employ universal construction signs and symbols to function safely. |
| 9.4.12.A.(3).2 | Use troubleshooting procedures when solving a maintenance problem to maintain project. |
| 9.4.12C.19 | Employ technological tools to expedite workflow. |
| 9.4.12C.36 | Demonstrate knowledge of personal and jobsite safety rules and regulations to maintain safe and healthful working conditions and environments. |
| 9.4.12C.37 | Demonstrate knowledge of employee rights and responsibilities and employers' obligations to maintain workplace safety and health. |

- 9.4.12.M.8 Use correct grammar, punctuation, and terminology to write and edit documents.
- 9.4.12.M.39 Maintain safe and healthful working conditions and environments to ensure employee safety.
- 9.4.12.M.30 Describe and use quality control systems and practices to ensure quality products and services.
- 9.4.12.M.32 Analyze and summarize how manufacturing businesses improve performance to demonstrate an understanding of various methods for enhancing production.
- 9.4.12.M.44 Employ leadership skills to accomplish goals and objectives.
- 9.4.12.M.46 Employ teamwork skills to achieve collective goals and use team members' talents effectively.
- 9.4.12.M.50 Apply ethical reasoning to a variety of situations in order to make ethical decisions.
- 9.4.12.M.52 Identify and demonstrate positive work behaviors and personal qualities needed to succeed in the classroom and/or to be employable.
- 9.4.12.M.53 Develop a Personalized Student Learning Plan to meet career goals and objectives.
- 9.4.12.M.54 Demonstrate skills related to seeking and applying for employment in a desired job.
- 9.4.12.M.55 Maintain a career portfolio to document knowledge, skills, and experience in a career field.
- 9.4.12.M.56 Demonstrate skills in evaluating and comparing employment opportunities in order to accept employment positions that match career goals.
- 9.4.12.M.57 Identify and exhibit traits for retaining employment.
- 9.4.12.M.58 Identify and explore careers in one or more career pathways to build an understanding of the opportunities available in the cluster.
- 9.4.12.M.(1).2 Research new manufacturing processes to manage production of new and/or improved products.
- 9.4.12.M.(1).3 Develop quality improvement processes to maintain quality during the manufacturing production process.
- 9.4.12.M.(1).4 Develop a continuous improvement plan to ensure production of high quality products that meet customer expectations.
- 9.4.12.M.(2).1 Demonstrate how to communicate with others to ensure production meets business requirements.
- 9.4.12.M.(2).9 Design a product that satisfies a customer's desires to demonstrate the relationship between production processes and meeting customer needs.
- 9.4.12.M.(3).5 Develop hands-on knowledge of equipment operation to identify maintenance needs and maximize performance.
- 9.4.12.M.(3).6 Analyze and select installation, customization, or upgrade techniques in order to ensure the proper functioning of manufacturing equipment.
- 9.4.12.M.(3).7 Create a preventive maintenance schedule to maintain manufacturing equipment, tools, and workstations.
- 9.4.12.M.(3).8 Describe predictive and preventive maintenance strategies used to ensure that production processes run smoothly.
- 9.4.12.M.(3).9 Identify and diagnose equipment problems in order to effectively repair manufacturing equipment.

- 9.4.12.M.(4).2 Analyze and select strategies for coordinating work teams to produce a product that meets quality assurance standards.
- 9.4.12.M.(4).3 Evaluate production operations for product and process quality to maintain quality assurance.
- 9.4.12.M.(4).4 Demonstrate understanding of ways to enhance product and process to meet quality standards.
- 9.4.12.M.(4).5 Develop continuous improvement activities for use in the manufacturing environment to enhance the quality of products or processes.
- 9.4.12.M.(4).6 Employ processes, data, and tools to produce a product that satisfies customer needs for quality, value-added products.
- 9.4.12.M.(4).7 Analyze and select continuous improvement processes to maintain quality products and processes.
- 9.4.12.M.(4).8 Inspect manufacturing materials, report quality issues, and release only manufacturing materials that meet quality specifications.
- 9.4.12.N.74 Employ information management techniques and strategies to assist in decision-making.
- 9.4.12.N.75 Employ planning and time management skills and tools to enhance results and complete work tasks.
- 9.4.12.N.76 Understand tools and strategies used to access, process, maintain, evaluate, and disseminate marketing information to assist with business decision-making.

III. METHODS OF STUDENT EVALUATION

Students are evaluated using the following criteria:

1. Class participation
2. Periodic quizzes and tests
3. Shop work
4. Shop Projects
5. Notebook
6. Finished Products

IV. TEXTBOOKS AND INSTRUCTIONAL MATERIALS

Precision Machining Technology, Peter J, Hoffman, Eric Hopewell, Brian Janes, Kent Sharp.Jr. Delmar Cengage Learning, United States 2012 ISBN: 13 978-1-4354-4767-7

Machining Fundamentals, Ninth Edition, John R. Walker and Bob Dixon, The Goodheart-Willcox Company, Inc. Tinley Park, IL. 2004 ISBN: 978-1-61960-209-0

Machining Fundamentals, Workbook, John R. Walker. The Goodheart-Willcox Company, Inc. Tinley Park, IL. 2014 ISBN: 978-1-61960-214-4

Mastercam, CNC Software, Inc., Tolland, Connecticut

V. INSTRUCTIONAL STRATEGIES

Various teaching methods are used in this course. Classroom instruction will be given using prepared worksheets, class notes, instructional videos, and textbook exercises. Hands-on demonstrations, Direct Instruction, Independent Practice and Small-Group Instruction will be the primary teaching methods. Computer instruction will include demonstrations, examples and independent practice. Linking prior knowledge and skills will enable students to demonstrate their variety of skills in all aspects of a typical production machine shop.

VI. SCOPE AND SEQUENCE CHART

KEY: I = INTRODUCED D = DEVELOPED IN DEPTH R = REINFORCED

Grade 10

I.	Careers in Machining Technology		D	R
II.	Safety		D	R
III.	Drawings	I	D	R
IV.	Hand Tools		D	R
V.	Jigs and Fixtures		D	R
VI.	Cutting Fluids		D	R
VII.	Sawing and Cutoff Machines	I	D	R
VIII.	Drills and Drilling Machines		D	R
IX.	Grinding		D	R
X.	Lathe		D	R
XI.	Tapers, Screw Threads and Broaching	I	D	R
XII.	Milling Machine		D	R
XIII.	Band Machine	I	D	R
XIV.	Metal Characteristics	I	D	R
XV.	Heat Treatment of Metal	I	D	
XVI.	Finishing	I	D	
XVII.	Metrology	I	D	
XVIII.	Mastercam		D	R

VII. PACING CHART

I.	Careers in Machining Technology	Week 1
II.	Safety	Week 2
III.	Drawings	Week 2
IV.	Hand Tools	Week 3 - 4
V.	Jigs and Fixtures	Week 5
VI.	Cutting Fluids	Week 6 - 7
VII.	Sawing and Cutoff Machines	Week 8 - 9
VIII.	Drills and Drilling Machines	Week 10 - 13
IX.	Grinding	Week 14 - 16
X.	Lathe	Week 17 - 20
XI.	Tapers, Screw Threads and Broaching	Week 21 - 23
XII.	Milling Machine	Week 24 - 27
XIII.	Band Machine	Week 28
XIV.	Metal Characteristics	Week 29
XV.	Heat Treatment of Metal	Week 30 - 31
XVI.	Finishing	Week 32
XVII.	Metrology	Week 33 - 34
XVIII.	Mastercam	Week 35 - 36

VIII. STUDENT HANDOUT

COURSE OVERVIEW

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Students skills will be enhanced with the continued use of Lathes, Milling Machines and Drilling Machines. Shop safety issues are reinforced. Students will reinforce their skills in the using Mastercam for the design of various projects. The student will also reinforce their skill in speaking the correct vernacular, as well as how to perform in a professional machine shop setting.

PROFICIENCIES

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